

## REMARKS

Reconsideration is respectfully requested.

By this amendment, a heading is provided to the Specification, and certain language clarifying the invention as described and claimed.

Antecedent support for these amendments is found at Page 6. No new matter is added.

Claims 19-27, 29, 30, 33 and 34 have been amended to provide a more precise and concise recitation of the elements of the claimed invention, and to address the rejections made under 35 U.S.C. § 112, second paragraph. No new matter is added, and support for these amendments is found at Page 6 of the specification as originally filed. The following remarks indicate how each of the specific objections to the recitations in the claims has been addressed by the above amendments.

In paragraph 9, the Office Action indicated that the specification failed to teach adequately how a region with “diffuse scattering characteristics” is also capable of appearing to an observer with a “particular shade of grey which viewed from any direction”, and that the specification failed to teach what is “consumed” to be the “different grey scale region structure types” (claim 19) and the “micrographic region structure types” (Claim 24).

Claim 19 has been amended by inserting the wording “each structure type having physical characteristics which provide a particular level of diffuse scattering of incident light”, and by specifying that the structure of each grey scale region is selected from a predefined group of different non-diffracting grey scale region structure types. Claim 24 has been amended to change “micrographic regions” to read “grey scale regions”, thereby

clarifying that the term “micrographic regions” of claim 24 has the same meaning as the term “grey scale regions” of Claim 19.

With reference to the rejection based on the term “too small to be separately resolvable to the human eye”, it has been deleted.

The term “a limited number” has been amended to recite that each grey scale region has a structure “selected from a predefined group of ... structure types”. The term “structure types” is noted that the amendment now clarifies the difference between a “structure” and a “structure type”. Each grey scale region is now defined as having a structure, and the particular structure is selected from a predefined group of structure types.

The objection to the term “appearing by reason of their different diffuse scattering characteristics” has been addressed by deleting the word “appearing” from Claim 19, so as to make the limitation more definite.

Claim 22 has been amended so that the term “same image” has been deleted.

The term “non-diffraction regions” has been changed to recite that this feature refers to the “grey scale regions”.

With respect to the term “in microscopic form an image”, an amendment to the typographic error in Claim 27 clarifies that the observer sees in macroscopic form an image which corresponds with a microscopic image represented in the surface relief structure of individual grey scale regions.

The term “the valuable document” has been deleted from Claim 34 which now refers to a surface on the document.

With respect to the term “appears to be continuous...appear when viewed...”, the claims have been amended to delete the words “appears to be”, and specifying that the graphical elements are continuous, and by removing reference to “appear when viewed”.

Amendments have been made so that the terms “gray scale regions”, “different gray scale region structure types,” “surface structure,” “micrographic regions,” “image,” “diffracting regions,” “non-diffracting regions” and “regions” have been clarified.

With respect to the prior art rejections, Claim 33 has been rejected as being anticipated by U.S. Patent No. 5,032,003 (Antes). Antes teaches an optically variable structure, in which the regions all have diffractive surface relief structures. Claim 33 has been amended to recite that the light scattering regions are “non-diffracting”, and that the

structures in each region are “non-periodic”, whereas the grooves in Antes are periodic. In any event, the optically variable surface pattern revealed in Antes is by definition “optically variable”. This means that the regions on the surface appear different when viewed from different viewing angles. In contradistinction, the regions of the present invention are recited as being “optically invariable”, so that the regions on the surface appear the same when viewed from any angle. Claim 33 specifically includes this limitation, and it is a feature, which Antes clearly does not possess.

Claims 19 to 36 have been rejected as being unpatentable over the present Applicant’s US Patent 5,428,479 (Lee, et al.) in view of the present Applicant’s US Patent 5,825,547 (Lee, et al.). Both of these prior US patents relate exclusively to optically variable images. The independent claims of the present application, Claims 19, 24 and 33, relate exclusively to optically invariable images. As an observer moves around one of the devices disclosed in US Patent Nos. 5,428,479 and 5,825,547, any given surface region will appear bright, then dark, then bright, then dark, as the viewing angle is changed. This is “optical variability”. In the present application, on the other hand, each of the independent claims specify that the intensity of a region remains the same when viewed from any direction. This is “optical invariability”. The independent claims of the present application have been amended to clarify this further, by specifying that the grey scale regions are “non-diffracting”.

It is possible that Applicant’s previous explanation of U.S. Patent No. 5,428,479, in the submission made on 10 January 2002, may have led to confusion in interpreting “optical variability”. A picture on a normal printed page is an optically invariable image: it looks the same when viewed from any angle. On the other hand, an image generated by light reflected from a diffractive surface relief structure is an optically variable image, because it looks different when viewed from different angles. Figure 1 of U.S. Patent No. 5,428,479 shows an optically invariable image of Queen Elizabeth, when it is printed on a normal page, before being encoded into a diffractive surface relief structure. Figure 2 shows a snapshot of an optically variable version of the same image (generated after the image has been encoded into a diffractive surface relief structure), which looks quite like the original. Figure 3 actually shows a contact print, but the effect is quite similar to a snapshot of the same optically variable image when viewed from another direction,

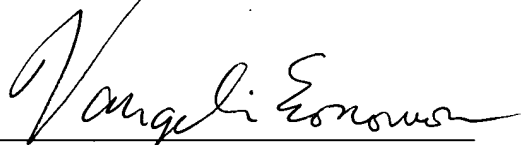
giving a sort of “negative” image. Pixel regions which were dark have become light, and *vice versa*. In optically variable images, the intensity of each pixel region varies according to the angle of observation.

With respect to the rejection of Claims 19-36 under 35 U.S.C. § 103, it has been suggested that “it is known in the art that the diffraction of light by grating into multiple diffraction orders of light rays is considered in the art as an act of diffusing scattering of light in different directions”. Applicants respectfully disagree and further submit that this is not an accurate statement. Diffraction is a process in which light (in the present case, reflected light) is concentrated into a series of alternately low and high intensities. Diffusion is a process in which light is dispersed, spread out, or “unconcentrated”. It is respectfully submitted that the claims, as amended, are patentable over the prior art.

For the above reasons, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections and earnestly solicit an indication of allowable subject matter.

September 12, 2002

Respectfully submitted,



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## MARKED UP COPY OF CLAIMS

19. (Twice Amended) A device having a surface relief structure which has a plurality of regions,

wherein the regions include gray scale regions, which are ~~too small to be separately resolvable to the human eye, being~~ smaller than 0.25 mm in width,

each gray scale region having a structure selected from predefined group ~~being one of a limited number of different~~ non-diffracting gray scale region structure types, each structure type having physical characteristics which provide a particular level of diffuse scattering of incident light ~~a surface structure which diffusely scatters light in all directions,~~

the different gray scale region types appearing~~having~~, by reason of their differing diffuse scattering characteristics, ~~to have~~ different intensities when the device is illuminated by a light source and viewed by an observer from any direction.

20. (Amended) A device according to claim 19 wherein each non-diffracting grey scale region structure type has one or more graphic elements, line art or text images represented in microscopic size in its surface relief structure.

21. (Amended) A device according to claim 20 wherein each microscopic ~~grey scale~~ region is of size 120 micron by 120 micron or less.

22. (Amended) A device according to claim 20 wherein ~~the same an~~ image is represented in the physical characteristics of the physical characteristics of each non-diffracting grey scale region structure type, the image in each case being substantially the

same but with differing diffuse scattering characteristics in differing non-diffracting grey scale region structure types.

23. (Amended) A device according to claim 20, wherein different graphic elements line art or images are represented in different non-diffracting grey scale region structure types.

24. (Twice Amended) A device having a surface relief structure which has a regular array of regions, each region being ~~too small to be separately resolvable to the human eye, being~~ smaller than 0.25 mm in width, wherein a large number of regions are non-diffracting grey scale ~~micrographic~~ regions with diffuse scattering characteristics ~~to diffusely scatter light in all directions,~~ each grey scale ~~micrographic~~ region having one or more graphic elements, line art or text images presented in microscopic size in its surface relief structure so that each grey scale ~~micrographic~~ region appears to an observer to be a particular shade of gray when viewed from any direction.

25. (Amended) A device according to claim 24 wherein each grey scale ~~micrographic~~ region has an identical image represented in its surface relief structure.

26. (Amended) A device according to claim 24 wherein each grey scale ~~micrographic~~ region has a structure which is ~~one of a limited number~~ selected from a predefined group of non-diffracting grey scale ~~micrographic~~ region structure types.

27. (Amended) A device according to claim 24 wherein, when the ~~device is~~ illuminated by a light source and viewed by an observer, the observer sees in ~~macroscopic~~ microscopic form an image which corresponds with a microscopic image represented in the surface relief structure of some or all of the grey scale regions.

29. (Amended) A device according to claim 28, wherein ~~in addition to the diffracting regions, the device includes one or more non-diffracting~~ grey scale regions which provide a contrast enhancing dark background to the diffraction image or images.

30. (Twice Amended) A device according to claim 28, wherein ~~in addition to the diffracting regions, the device includes one or more non-diffracting~~ grey scale regions which provide gray scale enhancement to the diffraction image or images.

33. (Twice Amended) A device having a surface relief structure which has a plurality of non-diffracting light scattering regions, each region having a number of non-periodic structures which scatter incident light in all different directions, so that the region appears to an observer to be a particular shade of gray when viewed from any direction.

34. (Thrice Amended) A valuable document having a surface which incorporates~~incorporating~~ a device according to one of claims 19, 24 or 33, including the surface having printed on it graphical elements~~printing~~ which [matches]match up with, and ~~appears when viewed to be~~ continuous with, graphical elements formed by the grey scale regions on the device ~~that appear when viewed to also be printed thereon.~~

## MARKED UP SPECIFICATION PARAGRAPHS

The paragraphs from Page 2, lines 18 to 26:

### **BRIEF SUMMARY OF THE INVENTION**

It is an object of the present invention to provide some improvements in security device technology.

According to one aspect of the present invention, there is provided a device having a surface relief structure which has a plurality of non-diffracting light scattering regions, each region having a number of non-periodic structures which scatter incident light in different directions, so that the region appears to an observer to be a particular shade of grey. This allows the device to simulate an optically invariable "printed" appearance, which is not capable of being copied by holographic techniques.

The paragraphs from Page 3, line 11 to Page 4, line 4:

According to another aspect of the invention, there is provided a device having a surface relief structure which has a plurality of regions, wherein the regions include grey scale regions which are ~~too small to be separately resolvable to the human eye,~~ smaller than 0.25mm in width, each grey scale region ~~being one of a limited number~~ having a structure selected from a predefined group of different non-diffracting grey scale region structure types, each structure type having physical characteristics which provide a particular level of diffuse scattering of incident light, the different grey scale region structure types ~~appearing,~~ having, by reason of the differing diffuse scattering characteristics, ~~to have~~ different intensities when the device is illuminated by a light source and viewed by an observer.

As a preferred feature, one or more of the non-diffracting grey scale region structure types may have one or more graphic elements, line art or images represented in microscopic size in their surface relief structures. This results in multiple replication of the graphic elements line art or images across the device, making it impossible to destroy all copies by reason of rough usage.



In this preferred form, the same image may be represented in each grey scale region structure type, but with differing diffuse scattering characteristics. Alternatively, different graphic elements, line art or images may be represented in the different grey scale region structure types.

According to another aspect of the invention there is provided a device having a surface relief structure which has a regular array of regions, each region being ~~too small to be separately resolvable to the human eye,~~ smaller than 0.25 mm in width, wherein a large number of the regions are ~~micrographic~~ non-diffracting grey scale regions, each ~~micrographic~~ grey scale region having one or more graphic elements, line art or text images represented in microscopic size in its surface relief structure.

In some embodiments, each ~~micrographic~~ grey scale region may have an identical image represented in its surface relief structure. In other embodiments, each ~~micrographic~~ grey scale region may have a structure, which is one of a limited number of micrographic region structure types.